Phase Alternated Nanomaterials for Efficient Evacuation of Thermal Energy

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Introduction

Particularly as there is a need to move toward three-dimensional processing structures, there is a need to be able to evacuate thermal energy from processors without the need for the heat to pass through the entire thickness of the processor. Even in a more traditional computer processor, it would be useful for heat to be able to dissipate without passing through transistors which are, themselves, heat-generating. The introduction of multi-core processors was an attempt to address this issue, but it did not solve the fundamental problem that heat tends to flow in all directions equally, resulting in the central part of the processor getting hotter than other parts. This paper will address itself to the subject of controlling the directionality of the flow of heat and this proposal may be used either in conjunction with or instead of the proposal of 1 December 2022.

Abstract

Materials such as water-ice which are in a frozen state have a tendency to reflect thermal and even acoustic energy, as opposed to liquids, which tend to absorb and channel thermal and acoustic energy.

If we, for example, were to fill the space between transistors with a liquid, this would allow for more efficient heat transport, but it would do nothing to shape the directionality of the heat transport. The problem of some heat radiation inward toward the core of a processor would still exist, even in a system in which nano-flow channels were incorporated into the spaces between transistors.

Even outside of the context of computing, it may be be useful to be able to focus heat energy (for example, in the operation of thermoelectric converters.) I propose that it would be useful for the purposes of channeling heat energy to construct a mechanism in which two types of materials are collocated which have differing freezing points. A material with a comparatively low freezing point could be placed in the center of a quantity of a material with a higher freezing point, creating a structure in which heat would be defected by the outermost portion of the structure, which would be frozen, but would be accepted by the liquid portion running through the center.

In such a system, the 1 December 2022 proposal would work more efficiently as it would allow for the artificially introduced acoustic energy, which is used to uptake and transport heat energy, to be introduced directly into the liquid channels, allowing transistor size to remain small and preventing the introduced of unwanted acoustic energy to the transistors which would only lead to the further heating.

Such a system of collocation of materials with different freezing points (used only at the gateways through which heat initially enters before entering flow channels) could be further optimized by exploiting a design proposed in the publication of 8 June 2025. In that publication, it was proposed that heat could be converted back into acoustic energy and that the acoustic energy could be converted into energy readily, even in the absence of a thermal differential between two sides of a more traditional thermoelectric plate. The material would consequently maintain an extremely cold resting temperature due to this conversion and would be capable of harvesting heat energy from relatively cold environments.

In this case, as we're dealing with a liquid and the objective is to simply evacuate heat from a system, I propose that we do with the coolant liquid precisely the same thing I proposed in the 8 June 2025 proposal. We use a variety of liquid substances with a variety different densities which begin, counter-intuitively, with a low degree of thermal conductivity and increasingly gradually in thermal conductivity with as smooth a transition as possible. The predicted result would be that the heat would be converted into sound, which allows the liquid to be, to a certain extent, self-cooling and make both the channeling of the heat and its elimination mechanically simpler.

As a gradual density taper is required and as the use of different types of liquids would lead to the intermixing of the liquids and to unwanted reflection of sound and heat at the boundaries between different liquid types, I propose that a single magnetic ferrofluid be used in a unique manner as a coolant.

I propose that the liquid flow channels be surrounded by a tunable electromagnet which is set at a lower level of power near the heat source and as a higher level of power at the point near the acoustic resonator. The strength of the magnetic field would be used to control the density of the fluid, allowing its density and thus thermal conductivity to gradually increase over distance. Although it is a fluid which is made of a great many magnetically-active particulates conductive velocity is determined by density for the same reason why the speed of sound in the material is affected in this way by density.

Just as in the proposal of 8 June 2025, that density must abruptly drop off near the resonator (although there must be some degree of taper prior to the liquid-solid interface/resonator.)

When we apply that system of gradually increasing density in a material followed by a sharp decrease in density, this has the effect of both pumping heat and converting it into sound; a siphon, if you will.

Conclusion

Such a system would open up possibilities both for processor cooling, such as the use of a liquid which does not require active circulation with mechanical pump because the heat is pumped using the density-taper pump effect. More efficient than introducing sound to transport heat is to directly convert the heat into sound and to eliminate it with resonators.

This proposal may also have larger-scale applications for heat transport. For example, traditional heat pumps used in HVAC systems rely upon the use of what are air conditioner compressors. Those systems would require less energy to operate if the heat in the outside coils, which must be made to be extremely cold could be transported to the interior coils over which the air to be heated is convected, could be transported in a solid-state mechanism which, in this case, would require no more energy than that required to activate the variable-strength electromagnet, which would likely incorporate features including automatic active adaptation to changing conditions and monitoring of the heat pumping effect so as to ensure the optimal density gradient needed to produce the effect.